1

90932

909320

NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

SUPERVISOR'S USE ONLY

Tick this box if you have NOT written in this booklet

Level 1 Chemistry 2021

90932 Demonstrate understanding of aspects of carbon chemistry

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of aspects of carbon chemistry.	Demonstrate in-depth understanding of aspects of carbon chemistry.	Demonstrate comprehensive understanding of aspects of carbon chemistry.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

A periodic table and other reference material are provided in the Resource Booklet L1–CHEMR.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–15 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (▨). This area may be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

QUESTION ONE

(a) Four organic substances are hexane, methane, octane, and pentane.

Draw the structural formulae of these substances in the boxes below.

Hexane	Methane
Octane	**Pentane**

(b) A student made some statements about the organic substances in part (a).

Circle whether the statements (i) and (ii) are true or false, and give a reason for each of your choices.

(i) These substances are all hydrocarbons.

Circle one: **True** **False**

Reason: _____

_____

_____

_____

(ii) Hexane, octane, and pentane are alkenes.

Circle one: **True** **False**

Reason: _____

_____

_____

Circle whether the statements (iii) and (iv) are true or false, and justify your choices with reference to relevant physical and / or chemical properties.

(iii) When an alkane burns, only water and carbon dioxide are formed.

Circle one: **True** **False**

Justification: _____

(iv) Methanol burns cleanly in air as it is made from natural gas.

Circle one: **True** **False**

Justification: _____

(c) Ethanol can be used as a fuel.

(i) How is ethanol produced during the process of fermentation?

In your answer, you should describe the process of fermentation, and explain any conditions that are required.

In the box below, give a balanced symbol equation for the fermentation reaction.

(ii) Complete the word equation and write the balanced symbol equation for the complete combustion of ethanol.

Word equation:

ethanol + oxygen →

Balanced symbol equation:

(iii) Ethanol is considered by many to be a fuel option that is better for the environment.

What are TWO advantages of using ethanol as a fuel compared to a hydrocarbon-based fuel such as petrol?

In your answer, you should link each advantage to effects on the environment.

QUESTION TWO

(a) The following table shows selected data for three compounds, A, B, and C.

Compound	Boiling point / °C	Solubility in water
A	64.7	Soluble
B	98.4	Insoluble
C	78.3	Soluble

These compounds are known to be heptane, methanol and ethanol.

Use the data in the table to determine the identity of the compounds listed above.

Compound A	
Compound B	
Compound C	

Justify your choices by referring to the information in the top table above.

Explain how you used the structure and properties of these compounds to distinguish between them.

(b) Butane gas burners used for camping usually have a warning label such as "Butane gas burners should not be used indoors or in confined spaces."

Source: www.gasmate.co.nz/products/backpacker-butane-stove

Why do manufacturers put this warning label on butane gas burners?

In your answer, you should elaborate on the combustion reactions that occur under different conditions when butane gas burners are used, and the effects on human health of any products of these reactions.

Give TWO balanced symbol equations for reactions occurring under different conditions.

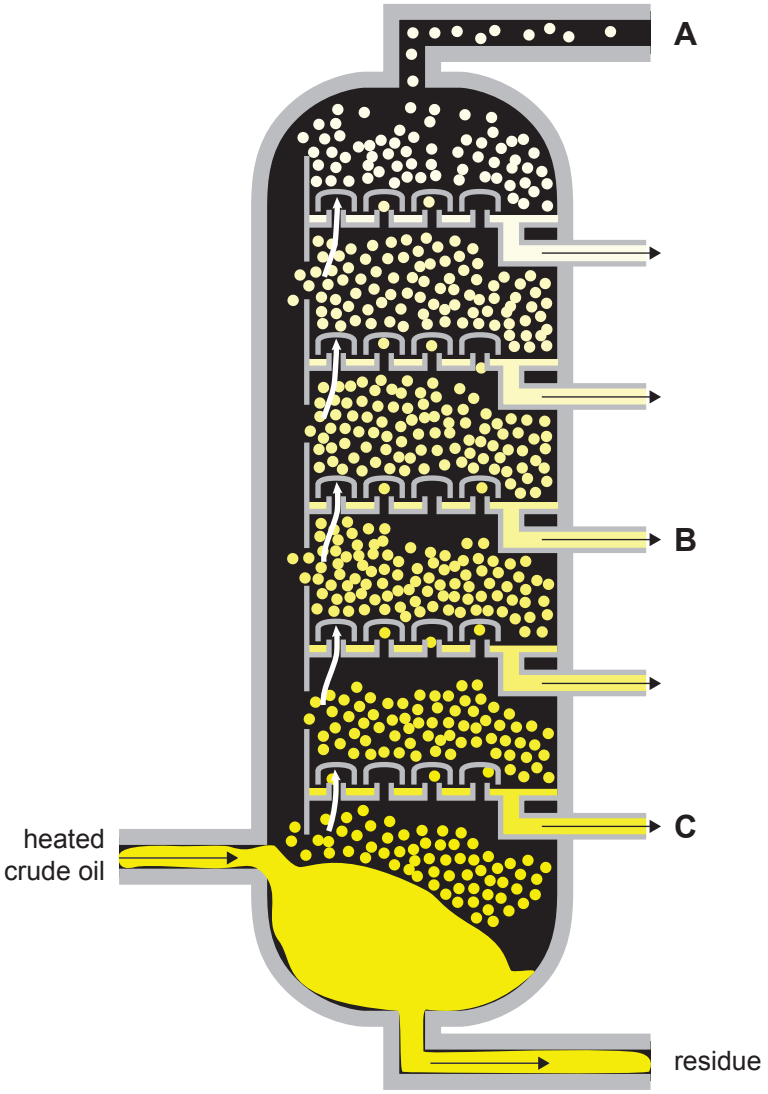
Balanced symbol equations for combustion of butane:

QUESTION THREE

(a) Three compounds found in crude oil include eicosane, $C_{20}H_{42}$, methane, CH_4, and nonane, C_9H_{20}.

The diagram below shows a distillation tower.

The parts of the tower where each of the three compounds leave are indicated on the diagram using the labels A, B, and C.



Adapted from https://courses.lumenlearning.com/atd-sanjac-introductorychemistry/chapter/hydrocarbons/

(i) Use the diagram, and your knowledge of fractional distillation, to identify compounds A, B, and C.

A	
B	
C	

(ii) How is crude oil separated using a distillation tower?

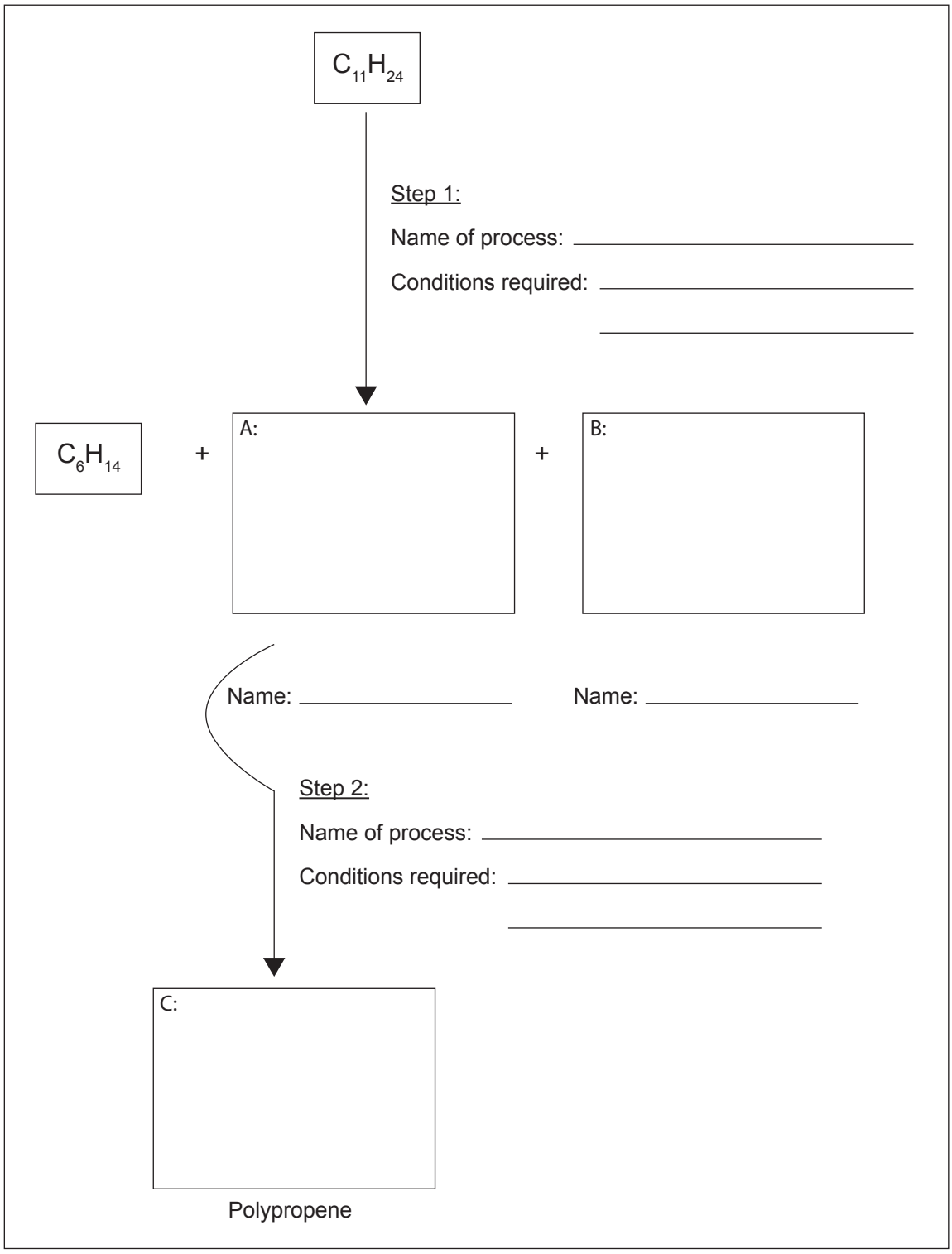
In your answer, you should use the diagram to explain the process. You should use TWO of compounds A, B, and C as examples, and link the process to the physical properties and chemical structures of the three compounds.

Question Three continues on the next page.

(b) (i) Undecane, $C_{11}H_{24}$, undergoes a process in which bonds are broken to form smaller hydrocarbons. One of these smaller hydrocarbons can be further reacted to form polypropene.

Complete the following reaction scheme for undecane, $C_{11}H_{24}$, by:

- naming and drawing the structures for the organic compounds A and B
- drawing two repeating units of the structure for C
- identifying the names of the processes and the conditions required in steps 1 and 2.



(ii) Neither C_6H_{14} nor compound B can be used to make polypropene.

Why is this?

In your answer, you should refer to the structures of both C_6H_{14} and compound B.

Extra space if required.
Write the question number(s) if applicable.

QUESTION NUMBER

Extra space if required.
Write the question number(s) if applicable.

QUESTION NUMBER

90932